Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 2 and 15	)	ET Docket No. 94-124
of the Commission's Rules to Permit	)	RM-8308
Use of Radio Frequencies Above 40 GHz	)	
For New Radio Applications	)	

REPLY COMMENTS

Apple Computer, Inc. ("Apple") hereby submits reply comments on the Federal Communications Commission's (the "FCC" or "Commission") Notice of Proposed Rule Making ("NPRM") in the above-referenced proceeding, released November 8, 1994. In this proceeding, the FCC proposes to make available 8.5 GHz of bandwidth for general unlicensed operations (other than unlicensed automotive radar systems), out of a total of 18 GHz of spectrum above 40.5 GHz (the "mm wave bands").

The Commission's bold effort to develop these "frontier" frequencies is commendable. By proposing a comprehensive allocation plan for a breathtaking amount of bandwidth, the Commission will provide opportunities for the development of a wide range of new technologies and services, thereby promoting the public interest.

While there is general agreement that the mm wave bands will become an important part of the NII, the specific array of communications services (particularly wide-band data communications services) that these bands will support will evolve over time. As a result, in developing its rules for the mm wave bands, the Commission must balance the benefits of rules that will enable technologies and applications to develop rapidly, against the risks of unleashing early approaches that could impair long-term benefits.

In addition, the Commission must continue to consider the mm wave band as part of an overall spectrum resource, as Commissioner Ness expressed at the FCC's February 7 meeting. The NPRM wisely recognizes that

industry will not be able to exploit fully the mm wave bands overnight.[1] Moreover, the mm wave frequencies will be suitable for some types of applications, but not for others. Accordingly, it is essential that the Commission continue to protect and promote the use of the 2 and 5 GHz bands for new technologies, especially unlicensed data. The Commission's recent provision of 10 MHz that can be used immediately for unlicensed, nomadic data, has sent a signal that is invigorating the computer industry and their widespread user constituency: wireless computing can now be a reality.

In addition to these general comments, Apple offers the following more specific recommendations regarding the unlicensed mm wave bands.

I. THE RULES SHOULD ENCOURAGE LONGER RANGE UNLICENSED COMMUNICATIONS IN SUITABLE PORTIONS OF THE MM WAVE BANDS.

The power limits proposed in the NPRM for the unlicensed mm wave bands generally would permit only very short-range, even in-room, communications paths. Several companies (in addition to Apple) support higher power limits and relatively unrestrained use of highly directional antennas, to achieve point-to-point data links up to several kilometers.[2] Both interference and health and safety issues must, of course, be addressed.

It may be that the same set of rules should not be applied to each of the unlicensed sub-bands. For example, propagation characteristics in the 59-64 GHz band are materially different from those of the other bands. Rather than raising the maximum permitted power in this band to provide sufficient link margins, for example, for outdoor paths subject to rainfall attenuation, it might be more advantageous to design rules for the 59-64 GHz band that will best support applications that demand very large bandwidths and short distances, thereby taking advantage of the bountiful frequency-reuse opportunities. In this context, the Commission's proposal to limit power to - 6 dBW EIRP appears to be a reasonable one.

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[1] NPRM at ¶ 4.

[2] See, e.g., comments of Hughes Aircraft Company (Communications Products Business Unit) at 5 *et seq.*

Similarly, different rules seem in order depending upon the population being served. The baseline power levels for devices subject to unrestrained usage by the general public could be similar to those for the 59-64 GHz band; higher power levels, particularly for point-to-point links, should be provided for systems installed by professionals and skilled users. Warning labels and other measures can be required and applied, reflecting the difference in permitted exposure to RF in "controlled" and "uncontrolled" environments now under examination in ET Docket 93-62. With proper restrictions, the power limits for such unlicensed devices should be the same as those applied for licensed devices, or, as suggested by Hewlett-Packard and others, in the range of 40 or 50 dBW EIRP. [3]

In addition to permitting more power in certain circumstances, the rules on antennas should be far more permissive than those set forth in Section 15.247 and should be defined only by a maximum EIRP, not by constraints on type of antenna or type of connector.

II. THE COMMISSION SHOULD SPECIFY MINIMUM RULES FOR THE UNLICENSED BANDS.

The Commission should adopt the widest and least restrictive possible sets of technical operating rules for the mm wave unlicensed bands. In general, these bands will be used for communications within a short radius or with coverage fields constrained by the patterns of highly directional antennas. As a result, technical rules will serve more as a spectrum etiquette than an interoperability standard. Such rules should be developed by an industry committee and proposed to the Commission in due course.[4] It is especially premature to impose any channelization subdivision of any of the bands.

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[3] Hewlett-Packard Comments at § 15-16.

[4] See Hewlett-Packard Comments at §18. Apple proposed such an industry-developed approach to the Data-PCS band, and recommended that it should be comprised of three primary elements: a listen-before-talk channel access algorithm, limits on how long a station could hold a channel before recontending for it on a "fair access" basis, and minimum power levels. See Apple's Petition for Rulemaking, Data-PCS, RM-7618 filed January 28, 1991. Apple subsequently organized an industry effort, much as H-P offers to do. We call attention to the arduous nature and only partial success of the multiple-year effort that ensued, and to the possibility that more than one "etiquette" may in fact be required. Apple will support H-P's energies and welcome the engagement of their skills.

III. THE COMMISSION SHOULD MAKE CLEAR THAT THE UNLICENSED AND AMATEUR BANDS WILL NOT BE IMPAIRED.

The Commission's recent experience in ET Docket 94-32 demonstrates the importance of providing certainty to manufacturers of unlicensed devices and users of the unlicensed bands.

When the Commission proposed to introduce a licensed service into the 2.4 GHz ISM band, its actions immediately placed the "Part 15" community at great risk. Companies and users both felt vulnerable to obliteration, and the uncertainty of the future status of unlicensed devices operating within the band dropped a blanket of despair over sales and financing.

Manufacturers and users of new mm wave devices will need to make significant commitments to these products if the unlicensed mm wave bands are to develop as envisioned. With so much yet to be learned, and so many technologies yet to be advanced, there are many risks in implementing products and applications in the mm wave bands. In order to spur necessary development and protect investment, the Commission should make clear at the outset that the bands set aside for unlicensed use will remain available for this use and will not diverted to licensed operations. There are enough handicaps in developing the mm wave bands: regulatory uncertainty should not contribute even more risk.

Similarly, amateur operators — who have seen their frequencies "nibbled away" over the years — deserve protection. Protection of the amateur service in the "4 mm band" (75.5-81.0 GHz) appears to depend upon the engineering designs of unlicensed automotive radar that would be allowed in that band. While the amateur community is amenable to sharing with those radar systems based upon current representations about such radars, Apple agrees with ARRL that the amateur service should be granted primary status from the outset of the redevelopment of this band, rather than having to remain vigilant against unforeseen changes in the nature of the automotive radar technologies.[5] Accordingly, the Table of Frequency Allocations should reflect the primary status of the amateur service.

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[5] See Comments of ARRL at 5-6.

IV. THE COMMISSION SHOULD CREATE A DEDICATED "EDUCATION BAND."

Several commenting parties called for a dedicated set-aside for a licensed educational service.[6] These entities make a forceful case that Apple need not repeat. In addition to the arguments made by these parties, Apple notes that educational activities will be among the most bandwidth- and information-intensive uses of radio networking, as well as the most beneficial.

V. THE COMMISSION SHOULD MODIFY ITS PROPOSED BAND PLAN IN SEVERAL RESPECTS.

In all likelihood, many of the distinctions between licensed and unlicensed services will be minimized in the mm wave bands, in that the protective assurances provided by the licensing process will often be accomplished, *de facto*, by physics. Notwithstanding that prognosis, the Commission should modify certain aspects of its proposed band plan.

The existing plan calls for seven 1 GHz-wide bands to be equally divided into licensed and unlicensed bands of 500 MHz each. While this subdivision provides for easy product migration or dual-mode devices, it also fragments the band significantly. Apple agrees with HP and others that 1 GHz bands of contiguous spectrum will be desirable for many applications, both licensed and unlicensed. A better mixture, therefore, might be to have three of the seven bands divided as present between licensed and unlicensed, and the remaining four bands redesignated to a single use, as follows:

- The 71-72, 84-85 and 122-123 GHz bands would each be divided into 500 MHz sub-bands for licensed and unlicensed, as proposed;
- The 103-104 and 126-127 GHz bands would be dedicated to unlicensed services; and

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[6] See Comments of "The Educational Parties" comprised of American Council on Education, American Association of Community Colleges, California State University, Sacramento, Education Network of Maine, as well as those of The Clarendon Foundation and GHz Equipment Co. ("GEC"). Several of these parties further identify the 40.5 to 41.5 GHz band as especially appropriate for these applications.

- The 116-117 and 152-153 GHz bands would be dedicated to licensed services.[7]

CONCLUSION

For the reasons discussed herein, Apple urges the Commission to move forward expeditiously with its proposal to open the mm wave bands to commercial uses, with the changes discussed above.

Respectfully submitted,

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March 1, 1995

[7] The plan herein is intended to provide for, but not require, duplex splits when desired.

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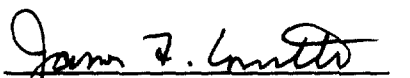

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CERTIFICATE OF SERVICE

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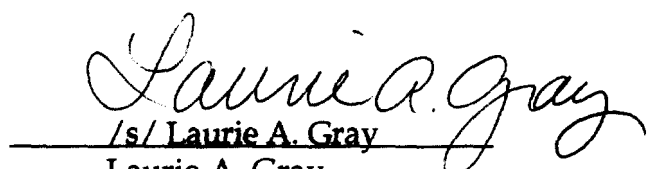

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